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Amendment to the Final Best Demonstrated Available Technology (BDAT) Background Document for Distillation Bottom Tars from the Production of Phenol/Acetone from Cumene K022

Versar, Inc., Springfield, VA

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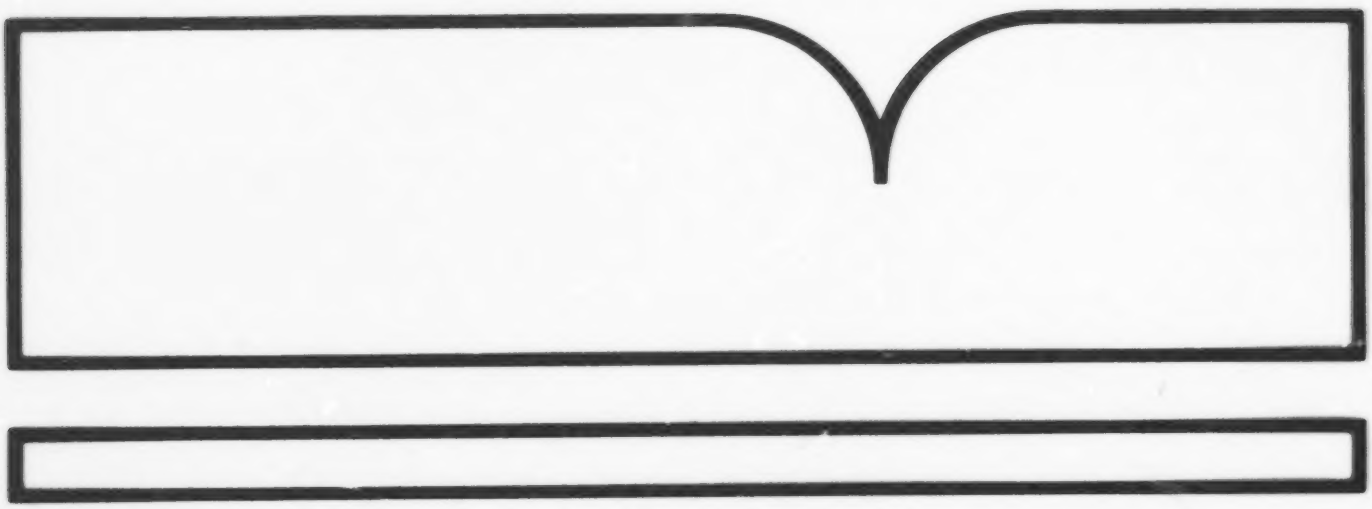

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FINAL

AMENDMENT TO THE

FINAL BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

BACKGROUND DOCUMENT

FOR

DISTILLATION BOTTOM TARS FROM THE PRODUCTION OF PHENOL/ACETONE FROM CUMENE

K022

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1.0 INTRODUCTION

The United States Environmental Protection Agency (EPA or Agency) established best demonstrated available technology (BDAT) treatment standards for nonwastewater forms of the listed hazardous waste identified in Title 40, Code of Federal Regulations, Section 261.32 (40 CFR 261.32) as K022, distillation bottom tars from the production of phenol/acetone from cumene. BDAT treatment standards are established in accordance with the amendments to the Resource Conservation and Recovery Act (RCRA) of 1976, enacted by the Hazardous and Solid Waste Amendments (HSWA) of November 8, 1984. BDAT treatment standards will be effective no later than May 8, 1990, and on and after the effective date, compliance with these BDAT treatment standards is a prerequisite under 40 CFR Part 268 for placement of the waste in land disposal units.

The treatment standards established for nonwastewater forms of K022 were based on EPA-generated and industry-submitted treatment performance data from fuel substitution of K022. Because the treatment of K022 by these fuel substitution units did not generate wastewaters, and because the Agency had not identified any other sources of treatment performance data that may have been used to develop treatment standards for K022 wastewaters, the Agency did not issue treatment standards for wastewater forms of K022 in the final rule published in the Federal Register on August 17, 1988 (53 Federal Register 31156).

However, since that time, it has come to the Agency's attention that generators of K022 may, through treatment, handling, or storage, generate a wastewater form of this waste. Consequently, the Agency is establishing treatment standards for organic and metal constituents in wastewater forms of K022.

The Agency prefers, whenever possible, to use wastewater treatment data from well-designed and well-operated wastewater treatment units rather than to base treatment standards for wastewater forms of a waste on constituent concentrations in incinerator scrubber water. EPA has compiled a

database of wastewater treatment data for use in establishing treatment standards for wastewater forms of U and P wastes and multi-source leachate. These data, compiled from a variety of sources, were transferred on a constituent-by-constituent basis to K022 organic constituents to develop treatment standards for K022 wastewaters. For metal constituents in K022 wastewaters, EPA transferred treatment performance data from chemical precipitation followed by vacuum filtration of K062. The specific constituents being regulated and the corresponding treatment standards are listed in Table 1-1, at the end of this section.

The treatment standards are based on the total concentration of each constituent in the waste for organic and metal constituents in wastewaters. The units used for total concentration of organic constituents are mg/l (parts per million on a weight-by-volume basis) for K022 wastewaters. If the concentrations of the constituents regulated in K022 wastewaters, as generated, are lower than or are equal to the treatment standards, then treatment of the waste would not be required prior to "land disposal," as defined by 40 CFR Part 268. The treatment standards published on August 17, 1988, for organic and metal constituents in nonwastewater forms of K022 are not being revised at this time.

This amendment to the Final Best Demonstrated Available Technology (BDAT) Background Document for K022 (Reference 2) presents EPA's rationale and technical support for selecting the constituents for regulation in wastewater forms of K022. Technologies that are applicable, demonstrated, and available for treatment of the constituents selected for regulation in K022 wastewaters, along with the treatment technologies identified as BDAT and the calculation of treatment standards for constituents regulated in K022 wastewaters, are discussed in EPA's Final Best Demonstrated Available Technology (BDAT) Background Document for U and P Wastes and Multi-Source Leachate (F039), Volume A (Reference 3). The treatment performance data on which these standards are based are summarized in Appendix A of this document and are discussed in greater detail in the Volume A document (Reference 3).

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The Agency's legal authority and promulgated methodology for establishing treatment standards and the petition process necessary for requesting a variance from the treatment standards are summarized in EPA's Methodology for Developing BDAT Treatment Standards (Reference 1).

Sections 2.0 through 6.0 of this document amend sections in the Final BDAT Background Document for K022 that refer to applicable and demonstrated treatment technologies, treatment performance data, accuracy-corrected data, constituents selected for regulation in wastewater forms of K022, and calculation of treatment standards, respectively. Section 7.0 contains acknowledgements and Section 8.0 lists references. Appendix A summarizes treatment performance data for organic constituents regulated in K022 wastewaters, and Appendix B contains quality assurance/quality control data for metal constituents regulated in K022 wastewaters.

Table 1-1

BDAT TREATMENT STANDARDS FOR K022

WASTEWATERS

Maximum for any Single Grab Sample	
BDAT List Constituent	Total Concentration (mg/l)
53. Acetophenone	0.010
142. Phenol	0.039
159. Chromium (total)	0.35
163. Nickel	0.47

Maximum for any 24-Hour Composite Sample	
BDAT List Constituent	Total Concentration (mg/l)
43. Toluene	0.080
106. Diphenylamine	0.52
219. Diphenylnitrosamine	0.40

2.0 AMENDMENT TO SECTION 3.0 (APPLICABLE/DEMONSTRATED TREATMENT TECHNOLOGIES) OF THE FINAL BDAT BACKGROUND DOCUMENT FOR K022

This section amends the discussion in Section 3.0 (Applicable/-Demonstrated Treatment Technologies) of the Final BDAT Background Document for K022. This section provides a discussion of the technologies that are applicable to treatment of organic and metal constituents in K022 wastewaters, and a determination of which, if any, of the applicable technologies can be considered demonstrated for the purpose of establishing BDAT.

To be applicable, a technology must theoretically be usable to treat the waste in question or a waste that is similar in terms of parameters that affect treatment selection. (Detailed descriptions of technologies that are applicable to listed hazardous wastes are provided in EPA's Treatment Technology Background Document (Reference 7). To be demonstrated, a technology must be employed in full-scale operation for treatment of the waste in question or a similar waste. Technologies available only at pilot- or bench-scale operations are not considered in identifying demonstrated technologies.

2.1 Applicable Treatment Technologies

The Agency recognizes that K022 wastewaters may be generated by treatment technologies including incineration. Since these wastewaters may contain hazardous organic constituents at treatable levels, applicable treatment technologies include those that destroy or reduce the total amounts of various organic compounds in the waste. Technologies that are applicable for treatment of the organic and metal constituents in K022 wastewaters are identified in Section 3.0 of the Final Best Demonstrated Available Technology (BDAT) Background Document for U and P Wastes and Multi-Source Leachate (F039), Volume A (Reference 3).

2.2 Demonstrated Treatment Technologies

2.2.1 Organic Constituents

Technologies that are demonstrated for treatment of organic constituents in K022 are discussed in the Final Best Demonstrated Available Technology (BDAT) Background Document for U and P Wastes and Multi-Source Leachate (F039), Volume A (Reference 3).

2.2.2 Metal Constituents

The Agency is not aware of any facilities that treat metal constituents in wastewater forms of K022. However, chemical precipitation followed by vacuum filtration is demonstrated for metal constituents in similar wastewaters, such as K062, as discussed in Section 3.0 of this document. Additionally, all of the treatment technologies that were identified as applicable for treatment of metal constituents in K083 wastewaters in EPA's Final Best Demonstrated Available Technology (BDAT) Background Document for U and P Wastes and Multi-Source Leachate (F039), Volume A (Reference 3) are considered to be demonstrated for treatment of these constituents.

The Agency is not aware of any other technologies that are demonstrated for treatment of wastewater forms of K022.

3.0 AMENDMENT TO SECTION 4.0 (PERFORMANCE DATABASE) OF THE FINAL BDAT BACKGROUND DOCUMENT FOR K022

This section supplements the discussion in Section 4.0 (Performance Database) of the Final BDAT Background Document for K022 to present the treatment performance data that were used to develop treatment standards for organic and metal constituents in wastewater forms of K022.

Where data are not available on the treatment of the specific waste of concern, the Agency may elect to transfer performance data from treatment of a similar waste or wastes. EPA's methodology for the transfer of treatment performance data is provided in the Agency's Methodology for Developing BDAT Treatment Standards (Reference 1). Transfer of treatment performance data is technically valid in cases where the untested wastes are generated from similar industries or similar processing steps, or have waste characteristics affecting treatment selection and performance that are similar to those of the tested wastes.

The Agency does not have any treatment performance data from treatment of wastewater forms of K022. Therefore, treatment performance data were transferred from other wastewaters that were judged to be similar to develop treatment standards for K022 wastewaters. These data are discussed in the following subsections.

3.1 Treatment of Organic Constituents

The treatment performance data that were used to develop treatment standards for organic constituents in K022 wastewaters are summarized in Appendix A of this document and are discussed in greater detail in EPA's Final Best Demonstrated Available Technology (BDAT) Background Document for U and P Wastes and Multi-source Leachate (F039), Volume A (Reference 3). These data were used because the Agency prefers to use performance data from appropriate wastewater treatment units that are well-designed and well-operated, rather than use data on constituent concentrations in scrubber water. Constituent concentrations in scrubber water represent the only other source of data

available for transfer to K022 wastewaters. The Agency believes that the wastewater treatment performance data summarized in Appendix A represent the best source of treatment performance data available for transfer to wastewater forms of K022. On a constituent-by-constituent basis, the tested wastes represented in these treatment performance data have similar waste characteristics affecting treatment performance and selection as the untested K022 wastewaters.

3.2 Treatment of Metal Constituents

The Agency examined all of the available wastewater treatment performance data. Performance data for treatment of metal constituents in various industrial wastewaters were developed by EPA's Office of Water. Additionally, EPA's database for chemical precipitation followed by filtration of wastewaters is included in the California List Notice of Data Availability (Reference 4). EPA screened the available data to determine whether any wastes are generated from similar industries or similar processing steps, or have similar waste characteristics as those expected for wastewater forms of K022. The metal constituents of concern in K022 are chromium and nickel, as shown by the waste characterization data included in the Final BDAT Background Document for K022. Based on waste characterization data, K062 mixed with metal-bearing characteristic hazardous wastes and K022 wastewaters are expected to contain the constituents of concern at similar concentrations. (Waste characterization data for the metal-bearing wastes tested by the Agency's Office of Water were insufficient to compare these wastes to K022 in terms of waste generation and waste characterization.)

FPA then examined the relative treatability of K022 wastewater and the mixture of K062 and metal-bearing characteristic hazardous wastes. As discussed in the Treatment Technology Background Document (Reference 7), waste characteristics that affect treatment performance for chemical precipitation include the concentrations and types of metals in the waste, the concentrations of dissolved solids in the waste, the oil and grease content of the waste, and whether the metals exist in the wastewater as a complex. As discussed above, both K022 and the K062 mixture are expected to contain the

constituents of concern. EPA considers K062 wastewaters to be more difficult to treat than K022 wastewaters because equal or higher concentrations of metals and dissolved solids are anticipated in K062 than in wastewater forms of K022. These higher concentrations of metals and dissolved solids would interfere more with the effectiveness of the precipitation reactions intended to remove the metals of concern. Since K022 wastewaters are frequently scrubber waters generated from incineration, oil and grease would not be expected to be present at significant concentrations. However, the K062 mixture contains oil and grease and may therefore be more difficult to treat than K022 scrubber water. Complex metals are not considered to be significant parameters in either waste. In consideration of these points, the mixture of K062 and metal-bearing characteristic hazardous wastes is considered to be more difficult to treat than wastewater forms of K022.

Based on these analyses, transfer of treatment performance data from chemical precipitation and vacuum filtration of K062 mixed with metal-bearing characteristic hazardous wastes to K022 wastewaters was judged to be valid. Treatment performance data for chemical precipitation followed by filtration from K062 mixed with metal-bearing characteristic hazardous wastes are included in Table 3-1.

Table 3-1

TREATMENT PERFORMANCE DATA COLLECTED BY EPA FOR TREATMENT OF K062 BY CHEMICAL PRECIPITATION FOLLOWED BY VACUUM FILTRATION[a]

BDAT LIST METAL CONSTITUENT	Sample Set #8		Sample Set #11		Sample Set #12	
	Concentration in Untreated K062 Mixture (ppm)	Concentration in Treated K062 Mixture Wastewater (ppm)	Concentration in Untreated K062 Mixture (ppm)	Concentration in Treated K062 Mixture Wastewater (ppm)	Concentration in Untreated K062 Mixture (ppm)	Concentration in Treated K062 Mixture Wastewater (ppm)
154. Antimony	<10	<1	<10	<1	<10	<1.00
155. Arsenic	<1	<0.1	<1	<0.1	<1	<0.10
156. Barium	<10	<1	<10	<1	12	<1.00
157. Beryllium	<2	<0.2	<2	<0.2	<2	<0.20
158. Cadmium	<5	<0.5	<5	<0.5	23	<5
221. Chromium (hexavalent)	0.13	<0.01	0.08	0.106	0.30	<0.01
159. Chromium (total)	831	0.15	395	0.12	617	0.18
160. Copper	217	0.16	191	0.14	137	0.24
161. Lead	212	<0.01	<10	<0.01	136	<0.01
162. Mercury	<1	<0.1	<1	<0.1	<1	<0.10
163. Nickel	669	0.36	712	0.33	382	0.39
164. Selenium	<10	<1	<10	<1	<10	<1.00
165. Silver	<2	<0.2	<2	<0.2	<2	<0.20
166. Thallium	<10	<1	<10	<1	<10	<1.00
168. Zinc	151	0.130	5	0.070	135	0.100

[a]Only 3 of the 12 sample sets analyzed at Plant B represented treatment by this treatment train. Other data sets included pretreatment technologies such as chromium reduction and treatment for cyanide. These data are not included here, since they were not considered for transfer, as discussed in Section 3.2 of this document.

Source: Envirite Onsite Engineering Report (Reference 5).

4.0 AMENDMENT TO SECTION 5.2 (IDENTIFICATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY - WASTEWATER) OF THE FINAL BDAT BACKGROUND DOCUMENT FOR K022

This section amends the discussion in Section 5.2 (Identification of Best Demonstrated Available Technology - Wastewater) of the Final BDAT Background Document for K022. This section discusses technologies that are available for treatment of metal constituents in K022 wastewaters and identifies BDAT for K022 wastewater metals. The technologies that were identified as BDAT for the organic constituents of concern in K022 are discussed in EPA's Final Best Demonstrated Available Technology (BDAT) Background Document for U and P Wastes and Multi-Source Leachate (F039), Volume A (Reference 3).

To determine the best technology, the Agency examines all available performance data for technologies that are identified as demonstrated for the waste of concern, or for a similar waste, to evaluate whether one or more of the technologies performs significantly better than the others. If performance data are available for only one technology for treating a waste, then that technology is "best." When data are available for more than one treatment technology, the "best" performing treatment technology is usually determined by statistical methods, as discussed in EPA's Methodology for Developing BDAT Treatment Standards (Reference 1). As discussed in Section 3.0, only one set of performance data was available for transfer to the metal constituents in wastewater forms of K022. In the case of the wastewater treatment performance data available to the Agency for organic constituents (and described in EPA's Final Best Demonstrated Available Technology (BDAT) Background Document for U and P Wastes and Multi-Source Leachate (F039), Volume A (Reference 3)), a data hierarchy was established to determine the "best" technology for each constituent. This hierarchy is described in the latter-referenced document.

The treatment technology that is found to perform best on a particular waste stream is then evaluated to determine whether it is "available." To be available, the technology must (1) be commercially

available, and (2) provide substantial treatment of the waste, as determined through evaluation of treatment performance data that have been corrected for accuracy. In determining whether treatment is substantial, EPA may consider data on a treatment technology's performance on a waste similar to the waste of concern provided that the similar waste is at least as difficult to treat as the waste of concern. If it is determined that the best-performing treatment technology is not available, then the next best technology is evaluated to determine whether it is "available."

4.1 Review of Treatment Performance Data

The available treatment performance data (presented in Section 3.0) were reviewed and assessed to determine whether they represent a well-designed and well-operated treatment system, whether sufficient analytical quality assurance/quality control measures were employed to ensure the accuracy of the data, and whether appropriate measures of performance were used to assess the performance of the particular treatment technology.

The treatment performance data and the design and operating data collected during the test of chemical precipitation followed by vacuum filtration were reviewed for the points described above. The appropriate measure of performance (total constituent concentration) was used to assess the treatment system. Additionally, the Agency has no reason to believe the treatment system was not well-designed and well-operated, or that insufficient analytical quality assurance/quality control measures were employed in generating treatment performance data.

4.2 Best Demonstrated Technology for Metal Constituents in K022 Wastewaters

As discussed above, chemical precipitation and vacuum filtration have been determined to be demonstrated for treatment of metal constituents in wastewater forms of K022. Because the Agency does not have treatment performance data for any other demonstrated and available technologies for treating metal constituents in K022 wastewaters or similar wastes, this

treatment train is considered to be the best. Therefore, the best demonstrated available technology (BDAT) for metal constituents in wastewater forms of K022 has been determined to be chemical precipitation and vacuum filtration.

4.3 Available Treatment Technologies for Metal Constituents in K022 Wastewaters

The best technology for treatment of metal constituents in K022 wastewaters, chemical precipitation followed by vacuum filtration, is considered to be commercially available. Furthermore, the Agency has determined that this technology provides substantial treatment of metals in K062 and therefore will provide substantial treatment of metals in K022. Consequently, this technology is considered BDAT for treatment of metal constituents in wastewater forms of K022.

5.0 AMENDMENT TO SECTION 6.2 (SELECTION OF REGULATED CONSTITUENTS - CONSTITUENT SELECTION) OF THE FINAL BDAT BACKGROUND DOCUMENT FOR K022

This section amends the discussion in Section 6.2 (Selection of Regulated Constituents - Constituent Selection) of the Final BDAT Background Document for K022. This section includes a discussion of the selection of organic and metal constituents for regulation in wastewater forms of K022.

Generally, constituents selected for regulation must satisfy the following criteria:

(1) The constituent must be on the BDAT List of regulated constituents. Presence on the BDAT List means that EPA-approved methods exist for analysis of the constituent in treated waste matrices.

(2) The constituent must be present in, or be suspected of being present in, the untreated waste. For example, in some cases, analytical difficulties (such as masking) may prevent a constituent from being identified in the untreated waste, but its identification in a treatment residual may lead the Agency to conclude that it is present in the untreated waste.

From a group of constituents that are eligible for regulation because they meet the above criteria, EPA may select a subset of constituents that represent the broader group. For example, from a group of constituents that react similarly to treatment, the Agency may select for regulation only those constituents that are (1) the most difficult to treat, based on waste characteristics affecting treatment performance; (2) representative of other constituents in the waste, based on structural similarities; and (3) present in the untreated waste in the highest concentrations. Selecting a subset of constituents for regulation is done to facilitate implementation of the compliance and enforcement program.

The Agency initially considered all constituents on the BDAT List for regulation in wastewater forms of K022. Table 5-1, at the end of this section, summarizes available waste characterization data for K022. If an analysis for a constituent was performed but the constituent was not detected

in the waste, the table indicates "ND" for that constituent. If the constituent was analyzed for and quantified at or above the detection limit, the table indicates "D" for that constituent. Constituents for which no analyses were performed are identified by "NA" (not analyzed). If a constituent is believed to be present in the untreated waste even if the characterization data do not indicate that it was detected, it is indicated in the "Believed to be Present" column in Table 5-1. Constituents marked with "Y" have been detected in the treated residual(s); thus, EPA believes they are present in the untreated waste even though they were not detected in the untreated waste.

Constituents may not have been detected in the untreated waste for several reasons. For example, the untreated waste samples may not have been analyzed for those constituents, or interferences by other constituents may have prevented detection. Some hazardous wastes are generated from processes that may use variable raw materials composed of different constituents. Therefore, all potentially regulated constituents would not necessarily be present in any given sample. For example, Plants 1 and 2 may both generate K022 as distillation bottoms from the production of phenol/acetone from cumene. However, Plant 1 may use raw materials A and B, while Plant 2 may use raw materials C and D. Because of the differences in the composition of the raw materials, K022 generated by Plant 1 may contain different constituents at different concentrations than K022 generated by Plant 2.

5.1 BDAT List Constituents Not Selected for Regulation

The Agency is not regulating all of the BDAT List constituents initially considered for regulation. As discussed further below, a BDAT List constituent was deleted from further consideration for regulation if: (1) the constituent was not detected in the untreated waste and is not suspected of being present in the untreated waste; (2) the constituent was not analyzed for in the untreated waste; or (3) other reasons, as discussed below. BDAT List constituents that remained following the deletions described in this subsection were further considered for regulation and are listed in Table 5-2 at the end of this section.

5.1.1 BDAT List Constituents Not Detected in the Untreated Waste

BDAT List constituents that were not detected or were suspected of being present in the untreated waste (labeled "ND" in Table 5-1) were deleted from further consideration for regulation.

5.1.2 BDAT List Constituents Not Analyzed for in the Untreated Waste

Some BDAT List constituents were deleted from further consideration for regulation because they were not analyzed for in the untreated waste (labeled "NA" in Table 5-1). Some constituents were not analyzed for in the untreated waste because it was extremely unlikely that these constituents would be present in the waste, based on knowledge of the process generating the waste.

5.1.3 BDAT List Constituents Deleted From Further Consideration for Regulation for Other Reasons

Copper, vanadium, and zinc were further considered for regulation in K022 wastewaters but were not selected for regulation. Although copper cyanide, vanadium pentoxide, and zinc cyanide are listed in Appendix VIII of 40 CFR Part 261, the metals are not listed individually. The Agency is only regulating copper, vanadium, and/or zinc when they are indicators of treatment performance for other Appendix VIII constituents. For K022 wastewaters, copper, vanadium, and zinc have not been identified as indicators of treatment performance for other Appendix VIII constituents and therefore are not being regulated.

Fluoride and sulfide were deleted from further consideration for regulation in K022 wastewaters because the technology determined to be BDAT for K022 wastewaters (chemical precipitation and vacuum filtration) does not provide effective treatment for these BDAT List constituents. Moreover, the Agency is unaware of any demonstrated technology for treatment of fluoride and sulfide in wastewater forms of K022 or similar wastes.

Barium was deleted from further consideration for regulation in K022 wastewaters because the BDAT treatment performance data transferred from chemical precipitation followed by vacuum filtration of K062 do not show effective treatment.

Tetrachlorodibenzofurans were deleted from further consideration for regulation because the accuracy of the quantification for these constituents could not be determined due to incomplete quality assurance/quality control information.

5.2 BDAT List Constituents Selected for Regulation

Constituents further considered for regulation in wastewater forms of K022 were selected from the BDAT List constituents that were detected in the untreated waste or were believed to be present in the untreated waste, unless they were deleted from consideration as discussed in Section 5.1. The constituents that remained following the deletions discussed in Section 5.1 are listed in Table 5-2.

Table 5-3 presents each constituent selected for regulation in K022 wastewaters after consideration of (1) the constituent concentration in the untreated waste, (2) whether the constituent is adequately controlled by regulation of another constituent, and (3) the relative difficulty in achieving effective treatment of the constituent by the technology identified as BDAT for K022 wastewaters (chemical precipitation and vacuum filtration).

The Agency's determination of adequate control for organic constituents was based on (1) an evaluation of the characteristics of the constituents that would affect the performance of incineration relative to the scrubber water residual, specifically, their estimated bond dissociation energies, and (2) the structural similarities among the constituents.

Twelve BDAT List organic constituents (shown in Table 5-2) were further considered for regulation in wastewater forms of K022 due to their

presence, or suspected presence, in the untreated waste. The bond dissociation energies of these twelve constituents, and their concentrations in the untreated waste were compared to determine which constituents had higher bond dissociation energies and higher concentrations in the untreated waste. Seven constituents were then deleted from further consideration for regulation because (1) they are believed to be adequately controlled by incineration of the five remaining organic constituents being regulated in K022 wastewaters, and/or (2) they are believed to be treated to similar concentrations as the five remaining constituents being regulated, based on structural similarities.

Based on the above discussion, the five BDAT List organic constituents selected for regulation in K022 wastewaters (shown in Table 5-3) are toluene, acetophenone, diphenylamine, diphenylnitrosamine, and phenol.

Two metal constituents, chromium and nickel, were also selected for regulation in wastewater forms of K022. All other BDAT List metal constituents initially considered for regulation in K022 wastewaters were not selected because these constituents were found (or suspected to be present) at low concentrations in the untreated waste, and are believed to be adequately controlled by the treatment standards for total chromium and nickel. By removing the metals that are present (or expected to be present) at the highest concentrations in the untreated waste (chromium and nickel in this case) using chemical precipitation followed by vacuum filtration, adequate treatment is expected to be provided for other metals present at lower treatable concentrations.

Table 5-1

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K022

BDAT List Constituent		Detection Status	Believed to be Present
Volatile Organics			
222.	Acetone	D	
1.	Acetonitrile	ND	
2.	Acrolein	ND	
3.	Acrylonitrile	ND	
4.	Benzene	ND	
5.	Bromodichloromethane	ND	
6.	Bromomethane	ND	
223.	n-Butyl alcohol	NA	
7.	Carbon tetrachloride	ND	
8.	Carbon disulfide	ND	
9.	Chlorobenzene	ND	
10.	2-Chloro-1,3-butadiene	ND	
11.	Chlorodibromomethane	ND	
12.	Chloroethane	ND	
13.	2-Chloroethyl vinyl ether	ND	
14.	Chloroform	ND	
15.	Chloromethane	ND	
16.	3-Chloropropene	ND	
17.	1,2-Dibromo-3-chloropropane	ND	
18.	1,2-Dibromoethane	ND	
19.	Dibromomethane	ND	
20.	trans-1,4-Dichloro-2-butene	ND	
21.	Dichlorodifluoromethane	ND	
22.	1,1-Dichloroethane	ND	
23.	1,2-Dichloroethane	ND	
24.	1,1-Dichloroethylene	ND	
25.	trans-1,2-Dichloroethene	ND	
26.	1,2-Dichloropropane	ND	
27.	trans-1,3-Dichloropropene	ND	
28.	cis-1,3-Dichloropropene	ND	
29.	1,4-Dioxane	ND	
224.	2-Ethoxyethanol	NA	
225.	Ethyl acetate	NA	
226.	Ethyl benzene	D	
30.	Ethyl cyanide	ND	
227.	Ethyl ether	NA	
31.	Ethyl methacrylate	ND	
214.	Ethylene oxide	NA	
32.	Iodomethane	ND	
33.	Isobutyl alcohol	ND	
228.	Methanol	NA	
34.	Methyl ethyl ketone	ND	

D - Quantified at or above the detection limit; however, these data have been claimed Confidential Business Information.
ND - Not detected.
NA - Not analyzed.
Source: CBI Background Document for K022 (Reference 2).

Table 5-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K022

BDAT List Constituent		Detection Status	Believed to be Present
Volatile Organics (Continued)			
229.	Methyl isobutyl ketone	NA	
35.	Methyl methacrylate	ND	
37.	Methacrylonitrile	ND	
38.	Methylene chloride	D	
230.	2-Nitropropane	NA	
39.	Pyridine	ND	
40.	1,1,1,2-Tetrachloroethane	ND	
41.	1,1,2,2-Tetrachloroethane	ND	
42.	Tetrachloroethene	ND	
43.	Toluene	D	
44.	Tribromomethane	ND	
45.	1,1,1-Trichloroethane	ND	
46.	1,1,2-Trichloroethane	ND	
47.	Trichloroethene	ND	
48.	Trichloromonofluoromethane	ND	
49.	1,2,3-Trichloropropane	ND	
231.	1,1,2-Trichloro-1,2,2-trifluoroethane	NA	
50.	Vinyl chloride	ND	
215.	1,2-Xylene	NA	
216.	1,3-Xylene	NA	
217.	1,4-Xylene	NA	
Semivolatile Organics			
51.	Acenaphthalene	ND	
52.	Acenaphthene	ND	
53.	Acetophenone	D	
54.	2-Acetylaminofluorene	ND	
55.	4-Aminobiphenyl	ND	
56.	Aniline	ND	
57.	Anthracene	ND	
58.	Aramite	ND	
59.	Benz(a)anthracene	ND	
218.	Benzal chloride	NA	
60.	Benzenethiol	ND	
61.	Deleted		
62.	Benzo(a)pyrene	ND	
63.	Benzo(b)fluoranthene	ND	
64.	Benzo(ghi)perylene	ND	
65.	Benzo(k)fluoranthene	ND	
66.	p-Benzoquinone	ND	

D - Quantified at or above the detection limit; however, these data have been claimed Confidential Business Information.
ND - Not detected.
NA - Not analyzed.
Source: CBI Background Document for K022 (Reference 2).

Table 5-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K022

BDAT List Constituent		Detection Status	Believed to be Present
Semivolatile Organics (Continued)			
67.	Bis(2-chloroethoxy)methane	ND	
68.	Bis(2-chloroethyl)ether	ND	
69.	Bis(2-chloroisopropyl)ether	ND	
70.	Bis(2-ethylhexyl)phthalate	ND	
71.	4-Bromophenyl phenyl ether	ND	
72.	Butyl benzyl phthalate	ND	
73.	2-sec-Butyl-4,6-dinitrophenol	ND	
74.	p-Chloroaniline	ND	
75.	Chlorobenzilate	ND	
76.	p-Chloro-m-cresol	ND	
77.	2-Chloronaphthalene	ND	
78.	2-Chlorophenol	ND	
79.	3-Chloropropionitrile	ND	
80.	Chrysene	ND	
81.	ortho-Cresol	ND	
82.	para-Cresol	ND	
232.	Cyclohexanone	NA	
83.	Dibenz(a,h)anthracene	ND	
84.	Dibenzo(a,e)pyrene	ND	
85.	Dibenzo(a,i)pyrene	ND	
86.	m-Dichlorobenzene	ND	
87.	o-Dichlorobenzene	ND	
88.	p-Dichlorobenzene	ND	
89.	3,3'-Dichlorobenzidine	ND	
90.	2,4-Dichlorophenol	ND	
91.	2,6-Dichlorophenol	ND	
92.	Diethyl phthalate	ND	
93.	3,3'-Dimethoxybenzidine	ND	
94.	p-Dimethylaminoazobenzene	ND	
95.	3,3'-Dimethylbenzidine	ND	
96.	2,4-Dimethylphenol	ND	
97.	Dimethyl phthalate	ND	
98.	Di-n-butyl phthalate	ND	
99.	1,4-Dinitrobenzene	ND	
100.	4,6-Dinitro-o-cresol	ND	
101.	2,4-Dinitrophenol	ND	
102.	2,4-Dinitrotoluene	ND	
103.	2,6-Dinitrotoluene	ND	
104.	Di-n-octyl phthalate	ND	
105.	Di-n-propylnitrosamine	ND	
106./219.	Diphenylamine/Diphenylnitrosamine	D	

D - Quantified at or above the detection limit; however, these data have been claimed Confidential Business Information.
ND - Not detected.
NA - Not analyzed.
Source: CBI Background Document for K022 (Reference 2).

Table 5-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K022

	BDAT List Constituent	Detection Status	Believed to be Present
Semivolatile Organics (Continued)			
107.	1,2-Diphenylhydrazine	ND	
108.	Fluoranthene	ND	
109.	Fluorene	ND	
110.	Hexachlorobenzene	ND	
111.	Hexachlorobutadiene	ND	
112.	Hexachlorocyclopentadiene	ND	
113.	Hexachloroethane	ND	
114.	Hexachlorophene	ND	
115.	Hexachloropropene	ND	
116.	Indeno(1,2,3-cd)pyrene	ND	
117.	Isosafrole	ND	
118.	Methapyrilene	ND	
119.	3-Methylcholanthrene	ND	
120.	4,4'-Methylenebis(2-chloroaniline)	ND	
36.	Methyl methanesulfonate	ND	
121.	Naphthalene	ND	
122.	1,4-Naphthoquinone	ND	
123.	1-Naphthylamine	ND	
124.	2-Naphthylamine	ND	
125.	p-Nitroaniline	ND	
126.	Nitrobenzene	ND	
127.	4-Nitrophenol	ND	
128.	n-Nitrosodi-n-butylamine	ND	
129.	n-Nitrosodiethylamine	ND	
130.	n-Nitrosodimethylamine	ND	
131.	n-Nitrosomethylethylamine	ND	
132.	n-Nitrosomorpholine	ND	
133.	n-Nitrosopiperidine	ND	
134.	n-Nitrosopyrrolidine	ND	
135.	5-Nitro-o-toluidine	ND	
136.	Pentachlorobenzene	ND	
137.	Pentachloroethane	ND	
138.	Pentachloronitrobenzene	ND	
139.	Pentachlorophenol	ND	
140.	Phenacetin	ND	
141.	Phenanthrene	ND	
142.	Phenol	D	
220.	Phthalic anhydride	NA	
143.	2-Picoline	ND	
144.	Pronamide	ND	
145.	Pyrene	ND	
146.	Resorcinol	ND	

D - Quantified at or above the detection limit; however, these data have been claimed Confidential Business Information.
ND - Not detected.
NA - Not analyzed.
Source: CBI Background Document for K022 (Reference 2).

Table 5-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K022

BDAT List Constituent		Detection Status	Believed to be Present
Semivolatile Organics (Continued)			
147.	Safrole	ND	
148.	1,2,4,5-Tetrachlorobenzene	ND	
149.	2,3,4,6-Tetrachlorophenol	ND	
150.	1,2,4-Trichlorobenzene	ND	
151.	2,4,5-Trichlorophenol	ND	
152.	2,4,6-Trichlorophenol	ND	
153.	Tris(2,3-dibromopropyl)phosphate	ND	
Metals			
154.	Antimony	ND	
155.	Arsenic	ND	Y
156.	Barium	ND	Y
157.	Beryllium	ND	Y
158.	Cadmium	ND	Y
159.	Chromium (total)	D	
221.	Chromium (hexavalent)	NA	
160.	Copper	ND	Y
161.	Lead	ND	Y
162.	Mercury	ND	
163.	Nickel	ND	Y
164.	Selenium	ND	
165.	Silver	ND	
166.	Thallium	ND	Y
167.	Vanadium	ND	Y
168.	Zinc	ND	Y
Inorganics			
169.	Cyanide	ND	
170.	Fluoride	D	
171.	Sulfide	D	
Organochlorine Pesticides			
172.	Aldrin	ND	
173.	alpha-BHC	ND	
174.	beta-BHC	D	
175.	delta-BHC	ND	

D - Quantified at or above the detection limit; however, these data have been claimed Confidential Business Information.
ND - Not detected.
NA - Not analyzed.
Y - Believed to be present in the untreated waste due to constituent presence in the treatment residual.
Source: CBI Background Document for K022 (Reference 2).

Table 5-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K022

BDAT List Constituent		Detection Status	Believed to be Present
Organochlorine Pesticides (Continued)			
176.	gamma-BHC	ND	
177.	Chlordane	ND	
178.	DDD	ND	
179.	DDE	ND	
180.	DDT	ND	
181.	Dieldrin	D	
182.	Endosulfan I	ND	
183.	Endosulfan II	D	
184.	Endrin	ND	
185.	Endrin aldehyde	ND	
186.	Heptachlor	D	
187.	Heptachlor epoxide	ND	
188.	Isodrin	ND	
189.	Kepone	ND	
190.	Methoxychlor	ND	
191.	Toxaphene	ND	
Phenoxyacetic Acid Herbicides			
192.	2,4-Dichlorophenoxyacetic acid	ND	
193.	Silvex	ND	
194.	2,4,5-T	ND	
Organophosphorous Insecticides			
195.	Disulfoton	ND	
196.	Famphur	ND	
197.	Methyl parathion	ND	
198.	Parathion	ND	
199.	Phorate	ND	
Polychlorinated Biphenyls (PCBs)			
200.	Aroclor 1016	ND	
201.	Aroclor 1221	ND	
202.	Aroclor 1232	ND	
203.	Aroclor 1242	ND	
204.	Aroclor 1248	ND	
205.	Aroclor 1254	ND	
206.	Aroclor 1260	ND	

D - Quantified at or above the detection limit; however, these data have been claimed Confidential Business Information.
ND - Not detected.
Source: CBI Background Document for K022 (Reference 2).

Table 5-1 (Continued)

STATUS OF BDAT LIST CONSTITUENT PRESENCE IN UNTREATED K022

BDAT List Constituent		Detection Status	Believed to be Present
Dioxins and Furans			
207.	Hexachlorodibenzo-p-dioxins	ND	
208.	Hexachlorodibenzofurans	ND	
209.	Pentachlorodibenzo-p-dioxins	ND	
210.	Pentachlorodibenzofurans	ND	
211.	Tetrachlorodibenzo-p-dioxins	ND	
212.	Tetrachlorodibenzofurans	D	
213.	2,3,7,8-Tetrachlorodibenzo-p-dioxin	ND	

D - Quantified at or above the detection limit; however, these data have been claimed Confidential Business Information.
ND - Not detected.
Source: CBI Background Document for K022 (Reference 2).

Table 5-2

BDAT LIST CONSTITUENTS FURTHER CONSIDERED FOR REGULATION IN K022 WASTEWATERS AFTER INITIAL SCREENING[a]

222. Acetone
226. Ethylbenzene
38. Methylene chloride
43. Toluene
53. Acetophenone
106. Diphenylamine
219. Diphenylnitrosamine
142. Phenol
155. Arsenic
157. Beryllium
158. Cadmimum
159. Chromium (total)
161. Lead
163. Nickel
166. Thallium
174. beta-BHC
181. Dieldrin
183. Endosulfan II
185. Endrin aldehyde

[a]All constituents on this list were either detected or were believed to be present in untreated K022, and were either selected for regulation (as shown in Table 5-3) or are believed to be controlled by regulation of another constituent.

Table 5-3

BDAT LIST CONSTITUENTS SELECTED FOR
REGULATION IN K022 WASTEWATERS

43.	Toluene
53.	Acetophenone
106.	Diphenylamine
219.	Diphenylnitrosamine
142.	Phenol
159.	Chromium (total)
163.	Nickel

6.0 AMENDMENT TO SECTION 7.2 (CALCULATION OF BDAT TREATMENT STANDARDS - WASTEWATER) OF THE FINAL BDAT BACKGROUND DOCUMENT FOR K022

This section amends the discussion in Section 7.2 (Calculation of BDAT Treatment Standards - Wastewater) of the Final BDAT Background Document for K022. This section includes a discussion of the calculation of treatment standards for metal constituents selected for regulation in wastewater forms of K022. Treatment standard calculations for the organic constituents selected for regulation in K022 wastewaters are presented and discussed in EPA's Best Demonstrated Available Technology (BDAT) Background Document for U and P Wastes and Multi-Source Leachate (F039), Volume A (Reference 3).

The Agency bases numerical treatment standards for regulated constituents on the performance of well-designed and well-operated BDAT treatment systems. These standards account for analytical limitations in available treatment performance data, and the data are adjusted for variabilities related to treatment, sampling, and analytical techniques and procedures.

Before treatment standards are calculated, the treatment performance data are corrected to account for analytical interferences associated with the chemical matrices of the samples. A complete discussion of the accuracy correction of metals treatment performance data is provided in Appendix B. Appendix B also contains the matrix spike recoveries and accuracy correction factors used to correct the treatment performance data, as well as the corrected treatment performance data.

After treatment performance data are corrected for accuracy, the arithmetic average of the corrected data is calculated for each regulated constituent. In cases where the constituent is not detected in the treatment residual at or above its detection limit, the detection limit is used to calculate the average constituent concentration in the treated waste. Table 6-1 (at the end of this section) presents the averages of the corrected treatment performance data for each metal constituent regulated in wastewater forms of K022.

The next step in calculating treatment standards is to determine the variability factor (VF) for each regulated constituent. The variability factor accounts for the variability inherent in treatment system performance, treacment residual collection, and treatment sample analysis. (For more information on the calculation of variability factors, see EPA's Methodology for Developing BDAT Treatment Standards (Reference 1).) Variability factors for the metal constituents regulated in K022 wastewaters are shown in Table 6-1.

Finally, a treatment standard is calculated for each regulated constituent by multiplying the average of the corrected treatment performance values by the variability factor for the constituent. Treatment standards for metal constituents in wastewater forms of K022 are presented in Table 6-1 and are discussed in greater detail below.

Treatment performance data for metal constituents in K022 wastewaters are not available. Therefore, the Agency is transferring performance data from treatment of K062 mixed with metal-bearing characteristic hazardous wastes using chemical precipitation followed by vacuum filtration to K022. The rationale for this transfer is presented in Section 3.0 of this document.

Chemical precipitation followed by vacuum filtration is a removal technology for metals in wastewater. The best measure of performance for a removal technology is the total amount of each constituent of concern remaining in the wastewater after treatment. Therefore, the BDAT treatment standards for metal constituents in K022 wastewaters were calculated based on total constituent concentration data; these data were transferred from treatment of K062 mixed with metal-bearing characteristic hazardous wastes (Reference 5).

Treatment standards for metal constituents in K022 wastewaters were calculated using three sample sets of data for chemical precipitation followed by vacuum filtration of K062 mixed with metal-bearing characteristic hazardous wastes. Table 3-1 in Section 3.0 presents the total concentrations for metal

constituents in the untreated and treated K062 mixed with metal-bearing characteristic hazardous wastes. The accuracy-corrected data and the treatment standard calculations for the metal constituents regulated in K022 wastewaters are presented in Table 6-1.

Table 6-1

CALCULATION OF TREATMENT STANDARDS FOR METAL CONSTITUENTS
REGULATED IN WASTEWATER FORMS OF K022

BDAT List Constituent Regulated in K022	Constituent From Which Treatment Performance Data in K062 Were Transferred	Arithmetic Average of Corrected Treatment Performance Values (ppm)	Variability Factor (VF)	Treatment Standard (Average x VF)(ppm)
159. Chromium (total)	Chromium (total)	0.221	1.583	0.35
163. Nickel	Nickel	0.387	1.212	0.47

7.0 ACKNOWLEDGEMENTS

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The following personnel from Radian Corporation were involved in preparing this document: John Williams, Program Manager; Mary Willett, Project Director; and Chrisanti Haretos, Task Leader.

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APPENDIX A

SUMMARY OF TREATMENT PERFORMANCE DATA FOR ORGANIC CONSTITUENTS REGULATED IN K022 WASTEWATERS

Acetophenone (U004). The data available for acetophenone were compiled from the NPDES database and are presented in Table 4-54A. In addition, leachate treatment performance data submitted by industry prior to proposal are presented in Table 4-54B. The treatment technology for which data are available is BT and the resulting average effluent concentration from the leachate data is 2.9 ppb.

At proposal, BDAT for acetophenone was not identified and the treatment standard was based on an effluent concentration of 10,361 ppb from data in the NPDES database. Between proposal and promulgation, EPA evaluated the industry-submitted leachate data available for acetophenone. Since these data for biological treatment (BT) showed substantial treatment of acetophenone, these data were used to calculate the promulgated standard. Therefore, BDAT for acetophenone is biological treatment.

The BDAT treatment standard for acetophenone was calculated using the effluent concentration of 2.9 ppb and the appropriate variability factor and accuracy correction factor. The calculation of the resulting BDAT treatment standard for acetophenone (0.010 ppm) is described in Section 6.0 and is shown in Table 6-10.

TABLE 4-54A
WASTEWATER TREATMENT PERFORMANCE DATA
FOR ACETOPHENONE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
*		MH0001571			32	10361.56			NPDES *

* Data used in developing proposed standard.

TABLE 4-54B
INDUSTRY-SUBMITTED LEACHATE TREATMENT PERFORMANCE
DATA FOR ACETOPHENONE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
BT		CWN	2.9	35	1	2.900		91.71	LEACHATE

Diphenylamine. No wastewater treatment performance data were available for diphenylamine from any of the examined sources. Treatment performance data were therefore transferred to this constituent from a constituent judged to be similar in elemental composition and functional groups within the structure of the chemical. For constituents represented by a U or P code, this means that constituents included in the same waste treatability group (see Appendix B) were candidates for transfer of data. Diphenylamine is similar in structure to constituents in treatability group III.A.3.f.(2) and the constituent used to transfer treatment performance data from was 2-naphthylamine. The treatment performance data for 2-naphthylamine are presented in Table 4-101. Using a transfer from this constituent results in a BDAT for diphenylamine of activated sludge biological treatment and a BDAT treatment standard of 0.52 ppm as described in Section 6.0 and shown in Table 6-10.

Diphenylnitrosamine. No wastewater treatment performance data were available for diphenylnitrosamine from any of the examined sources. Treatment performance data were therefore transferred to this constituent from a constituent judged to be similar in elemental composition and functional groups within the structure of the chemical. For constituents represented by a U or P code, this means that constituents included in the same waste treatability group (see Appendix B) were candidates for transfer of data. Diphenylnitrosamine is similar in structure to constituents in treatability group III.A.3.f.(6) and the constituent used to transfer treatment performance data from was N-nitrosodimethylamine. The treatment performance data for N-nitrosodimethylamine are presented in Table 4-105. Using a transfer from this constituent results in a BDAT for diphenylnitrosamine of activated sludge biological treatment and a BDAT treatment standard of 0.40 ppm as described in Section 6.0 and shown in Table 6-10.

Phenol (U188). Several sources of wastewater treatment performance data were available for phenol, including data from the ITD, BDAT, and WERL databases as well as literature WAO data. These data are presented in Table 4-109A. In addition, leachate treatment performance data submitted by industry just prior to proposal are presented in Table 4-109B. Technologies for which data are available include AL, API+DAF+AS, AS, ChOx, GAC, BT, LL, LL+SS, LL+SS+AC, PACT^{R}, RBC, RO, SBR, SS, TF, WOx, AS+Fil, and Anff. The treatment performance data represent bench-, pilot-, and full-scale studies.

At proposal, BDAT for phenol was identified as biological treatment and the treatment standard was based on an ITD median long-term average effluent concentration of 10.363 ppb from the ITD database. Between proposal and promulgation, EPA evaluated the industry-submitted leachate data available for phenol. Since this data for biological treatment (BT) showed substantial treatment of phenol, these data were used to calculate the promulgated standards. Therefore, BDAT for phenol is biological treatment.

The BDAT treatment standard for phenol was calculated using the effluent concentration of 10 ppb and the appropriate variability factor and accuracy correction factor. The calculation of the resulting BDAT treatment standard for phenol (0.039 ppm) is described in Section 6.0 and is shown in Table 6-10.

TABLE 4-109A
WASTEWATER TREATMENT PERFORMANCE DATA
FOR PHENOL

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Pilot	203A		100-1000	11	84.000		33	WERL
AL	Pilot	203A		100-1000	11	18.000		86	WERL
AL	Full	6B		100-1000	3	11.000		90.8	WERL
AL	Pilot	192D		100-1000		10.000		98.99	WERL
API+DAF+AS	Full	1482D		100-1000	4	85.000		89.5	WERL
AS	Full	1B		100-1000	5	2.000		98.6	WERL
AS	Full	1B		0-100	6	26.000		63	WERL
AS	Bench	202D		100000-1000000		0.010		99.99	WERL
AS	Full	6B		100-1000	39	10.000		96.4	WERL
AS	Full	1B		100-1000	5	8.000		97.2	WERL
AS	Pilot	203A		100-1000	11	14.000		89	WERL
AS	Full	201B		100-1000	31	20.000		92.6	WERL
AS	Full	1B		100-1000	6	1.000		99.89	WERL
AS	Full	6B		10000-100000	3	10.000		99.94	WERL
AS	Full	1B		100-1000	6	61.000		92.4	WERL
AS	Full	1B		0-100	3	1.000		96.4	WERL
AS	Full	975B		1000-10000		6.600		99.87	WERL
AS	Full	1B		100-1000	5	1.000		99.33	WERL
AS	Bench	1054E		100000-1000000		0.250		99.88	WERL
AS	Pilot	240A		0-100	11	10.000		90	WERL
AS	Full	6B		100-1000	7	15.000		98	WERL
AS	Full	1122E		10000-100000		4000.000		95.2	WERL
AS	Full	6B		100-1000	3	120.000		97.9	WERL
AS	Pilot	241B		100-1000	4	8.000		97.2	WERL
AS	Full	6B		1000-10000	10	21.000		99.64	WERL
AS	Full	975B		100-1000		20.000		87	WERL
AS	Full	6B		100-1000	11	10.000		96.3	WERL
AS	Full	1B		100-1000	6	1.000		99.44	WERL
AS	Full	1B		0-100	6	1.000		98.3	WERL
AS	Full	6B		100-1000	3	10.000		98.6	WERL
AS	Pilot	226B		100000-1000000	6	500.000		99.95	WERL
AS	Full	975B		1000-10000		160.000		95	WERL
AS	Full	6B		100000-1000000	2	10.000		99.99	WERL
AS	Pilot	204A		100-1000	8	14.000		94.6	WERL
AS	Pilot	192D		100-1000		10.000		98.99	WERL
AS	Full	6B		1000-10000	4	56.000		96.9	WERL
AS	Bench	1054E		10000-100000		1000.000		95	WERL
AS	Full	6B		100000-1000000	13	10.000		99.99	WERL
AS	Full	1B		100-1000	6	25.000		94.4	WERL
AS+Fil	Full	6B		10000-100000	3	13.000		99.98	WERL
AS+Fil	Full	6B		100-1000	15	10.000		98	WERL

TABLE 4-109A (Continued)
WASTEWATER TREATMENT PERFORMANCE DATA
FOR PHENOL

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AnFF	Pilot	231A		1000000		700.000		99.98	WERL
AnFF	Pilot	231A		1000000		30.000		99.99	WERL
AnFF	Bench	230A		100000-1000000		10.000		98.97	WERL
AnFF	Pilot	231A		100000-1000000		10.000		99.99	WERL
AnFF	Pilot	231A		100000-1000000		70.000		99.98	WERL
AnFF	Bench	230A		>1000000		1000.000		99.95	WERL
AnFF	Pilot	235D		100000-1000000		240.000		99.86	WERL
AnFFwGAC	Pilot	249D		1000000		50.000		99.99	WERL
CAC	Pilot	203A		100-1000	11	99.000		21	WERL
ChOx	Bench	975B		100-1000		16.000		93.3	WERL
ChOx	Bench	975B		100-1000		2.000		98.3	WERL
ChOx	Bench	975B		1000-10000		12.000		99.37	WERL
GAC	Bench	1054E		100-1000		10.000		99	WERL
GAC	Full	245B		100-1000	1	10.000		92.6	WERL
GAC	Full	237A		1000-10000	1	5.000		99.89	WERL
* BT	Full	1293	10	698564-978672	15	10.000			ITD-L *
LL	Full	K104	30	150000-300000	5	165000.000	21		BDAT
LL	Full	K103	30	1500000-3000000	5	84000.000	21		BDAT
LL+SS	Full	K103/K104	30	150000-3000000	5	2400.000	21		BDAT
LL+SS+AC	Full	K103/K104	30	150000-3000000	4	60.000	21		BDAT
PACT	Bench	190E		10000-100000		1.800		99.99	WERL
PACT	Bench	975B		1000-10000		2.000		99.96	WERL
PACT	Full	6B		1000-10000	3	30.000		98.6	WERL
PACT	Bench	975B		1000-10000		8.000		99.85	WERL
RBC	Pilot	603E		100000-1000000		1700.000		99.6	WERL
RBC	Pilot	192D		100-1000		10.000		98.99	WERL
RO	Full	250B		1000-10000		120.000		93.6	WERL
SBR	Pilot	1433D		10000-100000	16	1000.000		97.7	WERL
SBR	Pilot	227D		100000-1000000	1	1000.000		99.81	WERL
SBR	Bench	64D		100000-1000000		3000.000		99.63	WERL
SBRwPACT	Bench	64D		100000-1000000		1000.000		99.88	WERL
SExt	Pilot	1082E		>1000000		210000.000		95.4	WERL
SS	Pilot	1082E		100000-1000000		160.000		24	WERL
TF	Pilot	203A		100-1000	11	64.000		49	WERL
TF	Full	1B		100-1000	6	47.000		82	WERL
TF	Pilot	240A		0-100	10	8.000		91.3	WERL
TF	Full	1B		0-100	6	1.000		98.2	WERL
WOx	Bench	Zimpro		10000000	1	20000.000		99.8	WAO
WOx [B]	Bench	1054E		100000-1000000		27000.000		97.3	WERL
WOx [B]	Bench	1101D		>1000000		3600.000		99.92	WERL
WOx [B]	Bench	236A		>1000000	1	3000.000		99.97	WERL

* Data used in developing proposed standard.

TABLE 4-109B
INDUSTRY-SUBMITTED LEACHATE TREATMENT PERFORMANCE
DATA FOR PHENOL

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
BT		DOW	10	715-2500	3	10.000		99.32	LEACHATE

Toluene (U220). Several sources of wastewater treatment performance data were available for toluene, including data from the ITD and WERL databases, BDAT Solvents Rule data, literature WAO and PACT® data, and EPA WAO test data. These data are presented in Table 4-40. Technologies for which data are available include AL, AL+AS, API+DAF+AS, AS, AS+Fil, AirS, AirS+GAC, BT, BT+AC, GAC, PACT®, RO, SS, SS+AC, TF, WOx+PACT®, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the ITD database were used for setting the proposed and promulgated BDAT standard for this constituent for the following reasons:

(1) The ITD data represent treatment performance data from the OCPSF sampling episodes. The data collected by ITD include long-term sampling of several industries. These data are therefore a good reflection of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The ITD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining an ITD promulgated limit.

(3) A promulgated ITD limit represents data that have undergone both EPA and industry review and acceptance.

BDAT for toluene is being promulgated as proposed and is identified as steam stripping (SS). The BDAT treatment standard was calculated using the ITD median long-term average of 10 ppb and the ITD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for toluene (0.080 ppm) is described in Section 6.0 and is shown in Table 6-10.

TABLE 4-40
WASTEWATER TREATMENT PERFORMANCE DATA
FOR TOLUENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Full	6B		100-1000	3	10.000		98.2	WERL
AL	Bench	371D		1000-10000		90.000		97	WERL
AL	Full	1B		100-1000	6	32.000		96.1	WERL
AL+AS	Full	233D		1000-10000	21	4.000		99.85	WERL
API+DAF+AS	Full	1482D		10000-100000	4	11.000		99.93	WERL
AS	Bench	202D		10000-100000		10.000		99.98	WERL
AS	Full	6B		10000-100000	3	73.000		99.84	WERL
AS	Full	6B		1000-10000	3	10.000		99.57	WERL
AS	Full	975B		1000-10000		12.000		99.68	WERL
AS	Full	6B		10000-100000	3	76.000		99.90	WERL
AS	Bench	200B		100-1000	10	0.800		99.3	WERL
AS	Full	6B		1000-10000	24	10.000		99.73	WERL
AS	Full	1B		1000-10000	6	9.000		99.81	WERL
AS	Full	6B		1000-10000	15	10.000		99.88	WERL
AS	Full	6B		1000-10000	3	24.000		99.76	WERL
AS	Full	975B		1000-10000		280.000		96.3	WERL
AS	Full	6B		1000-10000	7	10.000		99.5	WERL
AS	Full	975B		100-1000		23.000		86	WERL
AS	Full	6B		1000-10000	33	20.000		99.8	WERL
AS	Pilot	226B		100000-1000000	7	300.000		99.85	WERL
AS	Full	6B		100-1000	14	10.000		97.8	WERL
AS	Full	6B		100-1000	4	10.000		97.6	WERL
AS	Full	1B		0-100	5	4.000		88	WERL
AS	Full	975B		100-1000		7.600		99.04	WERL
AS	Full	1B		100-1000	6	4.000		99.48	WERL
AS	Full	234A		0-100		0.700		97.1	WERL
AS	Full	1B		0-100	4	3.000		90.6	WERL
AS	Full	1587E		0-100		0.100		99	WERL
AS	Full	201B		100-1000	32	57.000		87	WERL
AS	Full	1B		100-1000	5	12.000		96.8	WERL
AS	Full	1B		0-100	4	1.000		98	WERL
AS	Full	234A		0-100		0.200		96.2	WERL
AS	Full	1B		100-1000	4	4.000		96.4	WERL
AS	Full	1B		0-100	5	2.000		97.6	WERL
AS	Full	238A		0-100	3	6.200		92.7	WERL
AS	Full	6B		100-1000	3	10.000		94.4	WERL
AS	Full	1B		0-100	5	2.000		97.1	WERL
AS	Full	1B		0-100	4	4.000		86	WERL
AS	Pilot	241B		100-1000	5	4.000		98.6	WERL

TABLE 4-40 (Continued)
WASTEWATER TREATMENT PERFORMANCE DATA
FOR TOLUENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Full	234A		0-100		0.200		96.9	WERL
AS	Full	1B		0-100	5	3.000		94	WERL
AS	Full	1B		100-1000	6	20.000		89	WERL
AS	Full	1B		0-100	6	1.000		97.3	WERL
AS	Full	1B		0-100	5	1.000		97.4	WERL
AS	Full	234A		0-100		0.200		97.7	WERL
AS	Full	1B		0-100	6	2.000		96.3	WERL
AS	Full	1B		100-1000	5	56.000		93.8	WERL
AS	Pilot	206B		100-1000	20	0.600		99.76	WERL
AS	Full	1B		100-1000	6	10.000		96.4	WERL
AS	Full	234A		100-1000		0.200		99.9	WERL
AS	Full	1B		100-1000	6	31.000		95.4	WERL
AS	Pilot	REF2		92000	6	23467.000			BDAT #
AS + Fil	Full	6B		10000-100000	3	10.000		99.98	WERL
AirS	Full	322B		100-1000	24	0.660		99.77	WERL
AirS	Pilot	1362E		0-100	3	1.700		95.3	WERL
AirS	Bench	1328E		10000-100000	5	2800.000		92.4	WERL
AirS	Full	69A		0-100		0.940		97	WERL
AirS	Full	322B		0-100	5	2.000		97.4	WERL
AirS	Pilot	224B		0-100	1	0.500		98.9	WERL
AirS	Full	322B		1000-10000	6	34.000		99.18	WERL
AirS	Full	322B		10000-100000	3	114.000		99.33	WERL
AirS+GAC	Full	229A		0-100	19	1.000		90	WERL
BT	Full	P206		834-57475	10	1491.000			BDAT #
BT	Full	P211		1154-4000	7	10.000			BDAT #
BT	Full	P202		60-155	20	10.000			BDAT #
BT	Full	P244		1109	1	10.000			BDAT #
BT	Full	P210		135-5805	2	10.000			BDAT #
BT	Full	P223		99-265	3	10.000			BDAT #
BT	Full	P217		34400-60000	3	73.000			BDAT #
BT	Full	P234		2350-35000	32	21.000			BDAT #
BT	Full	P242		1200-1533	2	10.000			BDAT #
BT	Full	P221		10-323	3	10.000			BDAT #
BT	Full	P208		140-640	14	10.000			BDAT #
BT	Full	P240		22700	1	10.000			BDAT #
BT	Full	P246		77-12938	9	630.000			BDAT #
BT	Full	P251		15840-26060	3	10.000			BDAT #
BT	Full	P253		66-230	3	103.000			BDAT #
BT	Full	P257		1730-12900	27	12.000			BDAT #
BT	Full	P265		37750-50000	3	10.000			BDAT #

ITD data presented in the BDAT Solvents Rule F001-F005 Background Document.

TABLE 4-40 (Continued)
WASTEWATER TREATMENT PERFORMANCE DATA
FOR TOLUENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
BT	Full	P286		24000-160000	3	76.000			BDAT #
BT	Full	P215		3300-4550	3	10.000			BDAT #
BT	Full	P230		3503-30347	15	10.000			BDAT #
BT	Full	REF4		680	1	4.000			BDAT #
BT+AC	Full	P246		77-12938	10	113.000			BDAT #
GAC	Pilot	435B		10000-100000		10.000		99.96	WERL
GAC	Full	245B		10000-100000	1	10.000		99.94	WERL
GAC	Pilot	REF7		120	1	0.300			BDAT #
PACT	Bench	200B		100-1000	13	0.300		99.75	WERL
PACT	Bench	242E		0-100		5.000		91.2	WERL
PACT	Bench	Zimpro		2730	1	1.000		99.9	WAO
PACT	Bench	Zimpro		57	1	5.000		91	WAO
RO	Full	250B		100-1000		20.000		92.5	WERL
RO	Pilot	250B		0-100		12.000		86	WERL
RO	Full	250B		1000-10000		420.000		94.7	WERL
* SS		0415**	10	19300-29000	3	12.000			ITD-L *
SS	Full	6B		1000-10000	2	10.000		99.71	WERL
SS	Full	6B		10000-100000	3	12.000		99.95	WERL
* SS		0415*	10	2570-4230	4	22.300			ITD-L *
SS	Pilot	REF4		92000	5	42.000			BDAT #
SS	Full	P246		57-98	4	10.000			BDAT #
SS+AC	Full	P297		640-8650	3	11.000			BDAT #
TF	Full	6B		100-1000	3	10.000		96.3	WERL
TF	Full	1B		0-100	5	10.000		88	WERL
TF	Full	1B		0-100	6	7.000		86	WERL
TF	Full	1B		0-100	5	2.000		97.2	WERL
TF	Full	1B		0-100	6	1.000		98.2	WERL
TF	Full	1B		100-1000	4	7.000		97.8	WERL
UF	Pilot	250B		100-1000		84.000		35	WERL
WOx		REF10		8500000	1	200000.000			BDAT #
WOx	Bench	Zimpro		4330000	1	12000.000		99.7	WAO
WOx	Bench	Zimpro		5000	1	500.000		90	WAO
WOx	Pilot	Zimpro		30000	1	500.000		98.3	WAO
WOx	Full	Zimpro	50	62000-82000	2	10950.000			WAO
WOx	Full	242E		100-1000		57.000		72	WERL
WOx	Pilot	78D		10000-100000		500.000		98.3	WERL
WOx + PACT	Pilot	Zimpro	5	130000-180000	3	5.000		99.9	WAO
WOx [b]	Bench	78D		1000-10000		500.000		90	WERL
WOx [b]	Bench	78D		10000-100000		1000.000		98.8	WERL
WOx [b]	Bench	1054E		10000-100000		500.000		98.9	WERL
WOx [b]	Bench	1054E		1000000		220000.000		95.7	WERL

ITD data presented in the BDAT Solvents Rule F001-F005 Background Document.
* Data used in developing proposed standard.

APPENDIX B

ACCURACY CORRECTION OF TREATMENT PERFORMANCE DATA

APPENDIX B

ACCURACY CORRECTION OF TREATMENT PERFORMANCE DATA

The treatment performance data used to determine treatment standards for wastewater forms of K022 were adjusted to account for analytical interferences associated with the chemical matrices of the samples. Generally, treatment performance data were corrected for accuracy as follows: (1) a matrix spike recovery was determined for each BDAT List constituent detected in the untreated or treated waste; (2) an accuracy correction factor was determined for each of the above constituents by dividing 100 by the matrix spike recovery (percent) for that constituent; and (3) treatment performance data for each BDAT List constituent detected in the untreated or treated waste were corrected by multiplying the reported concentration of each constituent by its corresponding accuracy correction factor. The procedure for accuracy correction of the data is described in further detail below.

Matrix spike recoveries are developed by analyzing a sample of a treated waste for a constituent and then re-analyzing the sample after the addition of a known amount of the same constituent (i.e., spike) to the sample. The matrix spike recovery represents the total amount of constituent recovered after spiking, minus the initial concentration of the constituent in the sample, and the result divided by the spike concentration of the constituent.

Matrix spike recoveries used to adjust the treatment performance data transferred to metal constituents in K022 wastewaters are shown in Table B-1. Duplicate matrix spikes were performed for some BDAT List constituents. If a duplicate matrix spike was performed for a constituent, the matrix spike recovery used for that constituent was the lower of the two volumes from the first matrix spike and the duplicate spike. An accuracy correction factor of 1.00 was used when matrix spike and duplicate matrix spike recoveries both exceeded 100%, so that the data were not adjusted to concentrations below the detection limits.

Where a matrix spike was not performed for an organic constituent, the matrix spike recovery for that constituent was derived from the average matrix spike recoveries of the appropriate group of constituents (e.g., volatile or semivolatile organics) for which recovery data were available. In these cases, the matrix spike recoveries for all volatiles or semivolatiles from the first matrix spike were averaged. Similarly, an average matrix spike recovery was calculated for the duplicate matrix spike recoveries. The lower of the two average matrix spike recoveries of the volatile or semivolatile group was used for any volatile or semivolatile organic constituent for which no matrix spike was performed.

The accuracy correction factors for the data used to calculate treatment standards for metal constituents in K022 wastewaters are presented in Table B-2. The corrected treatment concentrations for the metal constituents regulated in K022 wastewaters are presented in Table B-3.

TABLE B-1

MATRIX SPIKE RECOVERIES FOR METALS IN WASTEWATER RESIDUALS[a]

Spike Constituent	Original Amount Found (ppm)	Amount Spiked (ppm)	Sample Result: Amount Recovered (ppm)	Sample Result: Percent Recovery[b] (%)	Duplicate Sample Result: Amount Recovered (ppm)	Duplicate Sample Result: Percent Recovery[b] (%)
159. Chromium (total)	<0.004	0.050	0.035	70	0.034	68
163. Nickel	0.203	1.00	1.14	94	1.128	93

[a]Matrix spike recoveries were transferred from data in the Onsite Engineering Report for Horsehead (Reference 6).

[b]Percent recovery = 100 x $(C_1 - C_o)/Ct$, where C_1 = amount recovered, C_o = original amount found, and C_t = amount spiked.

Source: Onsite Engineering Report of the Third Third Incineration Treatability Test at the John Zink Company, Tulsa, Oklahoma (Reference 8).

Table B-2

SUMMARY OF ACCURACY CORRECTION FACTORS FOR METAL CONSTITUENTS[a]

BDAT List Constituent	Accuracy Correction Factor[b]
159. Chromium (total)	1.471
163. Nickel	1.075

[a]The data used to calculate these accuracy correction factors were transferred from data in the Onsite Engineering Report for K061 (Reference 6).

[b]The accuracy correction factor is equal to 100 divided by the percent recovery.

Table B-3

ACCURACY-CORRECTED DATA USED TO CALCULATE TREATMENT STANDARDS FOR METAL CONSTITUENTS REGULATED IN K022 WASTEWATERS

BDAT List Constituent	Corrected Total Concentration in the Treated K062 Wastewater Mixture[a] (ppm) Sample Set: 1	2	3
159. Chromium (total)	0.221	0.176	0.265
163. Nickel	0.387	0.355	0.419

[a]Constituent concentrations have been corrected by multiplying the concentration by the accuracy correction factor (ACF) for each constituent.